

## POSTURAL ANALYSIS OF VITICULTURE WORKERS IN PRUNING ACTIVITY

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### ABSTRACT

*A study was conducted in viticulture i.e. grape farm to do the postural analysis of the workers by using conventional and improved methods. Place of study was Thukkuguda village, Hyderabad, Telangana state. Data was collected from fifteen female workers by using an observation schedule and a questionnaire. The grape varieties cultivated in this village are Manik Chaman, Ganesh and Sonaka which are dried for raisins. Results revealed that the space between the rows in the vineyard is 9ft and space between the plants is 5.6 ft with 4.9 ft height of the plants. In this region, normally pruning is done by women workers with bare hands by working for long hours in strenuous, awkward and repetitive postures with over stretching the upper body.*

*Almost all the workers were obese in a range of 25-40 BMI. All the respondents seemed to have normal blood pressure irrespective of the age group. There was a reduction in the pinch grip fatigue due to the use of ring cutter for pruning vines. Total Cardiac Cost of Work was reduced in improved method by 2 per cent. The percentage of increase in cuts per minute by using ring cutter was 57 per cent.*

**KEYWORDS:** Viticulture & Postural Analysis of the Workers

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### INTRODUCTION

Grape cultivation in India is done in various cities like Maharashtra, Karnataka, Telangana, Andhra Pradesh, Tamil Nadu in southern zone, Punjab and Haryana in the northwestern region, western Uttar Pradesh, Rajasthan and Madhya Pradesh covering an area of 123 thousand hectares. In Telangana region, mostly grape vineyards are found in and around Hyderabad i.e. Rangareddy and Medak districts. Since these places are in a hot tropical region, double pruning – one in March-May and another in October-November and a single harvest is done i.e in January-April. The number of nodes retained on a cane varies with the variety and cane thickness.

Mostly women are responsible for planting, pruning, grafting, harvesting and processing grapes in viticulture. In this region, normally pruning is done by women workers with bare hands by working for long hours in strenuous, awkward and repetitive postures with over stretching the upper body. In the grape cultivation, occupational risk was highest in land preparation, pruning activity and plant protection activity (Kumari S. and Mehta M. 2017). When secateurs were used for long time, respondents experienced grip fatigue and pain mainly in wrist, arm, palm and finger (Kumari S. et al., 2017). Even in strawberry fields, workers felt fatigue due to awkward postures which had influenced their health (Kumudini and Hasegawa, 2009).

The present study is taken up to i) assess the physiological parameters of female workers engaged in

pruning activity i) understand the postural problems faced by workers in pruning activity ii) study the impact of using a ring cutter in reducing postural problems iii) compare the degree of flexion in pruning activity by using traditional and improved methods.

## METHODOLOGY

The study was conducted in Thukkuguda village, Maheswaram mandal of Rangareddy district on a sample of 15 respondents who were selected randomly. Questionnaire cum observation schedule was used to record personal data and readings during the experiment were taken as the subjects performed the pruning task in peak summer in the month of May. The grape varieties cultivated in this village are Manik Chaman, Ganesh and Sonaka which are dried for raisins. In hot tropical region like Telangana, vines are pruned twice but only one crop is harvested. All canes in a vine are pruned back to single node spurs in March-May to develop canes and the canes are forward pruned in October-November for fruiting. The space between the rows in the vineyard is 9ft and space between the plants is 5.6 ft with 4.9 ft height of the plants.

Prior to the study, subjects were explained about the objectives of the study for seeking their co-operation. Subjects were made to rest for 15 min before taking the experimental data i. heart rate by using polar heart rate monitor, height and weight by anthropometric scale and weighing machine respectively, pinch strength by using pinch gauge and blood pressure by using a blood pressure monitor. After the resting period, subjects were requested to perform pruning for 15 min in the traditional method i.e. with bare hands. Heart rate was noted during the work with every 5 min interval. The average of these readings was taken. Posture adopted during the activity was recorded by using a video camera. Then the videos were uploaded in Kinovea software for analysis.

After the pruning activity was done by traditional method, the subjects were made to take rest for 30 min. Recovery heart rate was taken for 5 min with an interval of one minute or till it reached resting value by making the subjects sit in a relaxed position.

Based on the heart rate readings, various physiological parameters like average heart rate during rest, work and recovery period, TCCW, CCW, CCR, Increased average heart rate during work and after recovery were assessed by using standard formulae as given below.

Total cardiac cost of work (TCCW) = Cardiac cost of work (CCW) + cardiac cost of recovery (CCR)

Cardiac cost of work (CCW) = Increased average heart rate x Duration of work

Increased average heart rate during work = Average working heart rate – Average heart rate during rest

Cardiac cost of recovery (CCR) = Increased average heart rate during recovery x Duration; Increased Average heart rate during recovery = Average recovery heart rate – Average heart rate during rest

Pulse pressure = Systolic pressure- Diastolic pressure

Grip fatigue (%) =  $\frac{Sr - Sw}{Sr} \times 100$

Where Sr is strength of muscles at rest and Sw is strength of muscles at work

## RESULTS AND DISCUSSIONS

### Physical Characteristics of the Respondents

**Table 1: Personal Profile of the Respondents**

Personal Characteristics	Mean	SD
Age in years	32.5	6.8
Height in cm	151.67	5.55
Weight in kg	52.27	13.46
BMI	22.73	5.66

Mean age of the respondents was 32.5 years, mean height was 151.7 cm and mean weight was 52.3 kg. Based on the height and weight, Body mass index (BMI) was calculated which was observed to be 22.74 with a variation of  $\pm 5.66$  kg/m<sup>2</sup>. Majority of the respondents fell under the category of Obesity class II with BMI ranging from 35 to 39.99 kg/m<sup>2</sup>.

**Table 2: Body Type of the Respondents Based on Quetelets Index**

Quetelets Index	Frequency	Percentage
Ecotomorph (<20 BMI)	4	26.67
Mesomorph (>20-25 BMI)	7	46.66
Endomorph (>25 BMI)	4	26.67
<b>Total</b>	<b>15</b>	<b>100.00</b>

Respondents belonged to 35-39 age group found to have over weighted when compared to other age groups. While 30-34 age group respondents were having underweight which might be due to the stage of life cycle with preschool children to take care. Further analysis showed that an equal percentage of respondents fell under the categories of ectomorph and endomorph and nearly 47 per cent belonged to mesomorph body type category.

### Physiological Characteristics of the Respondents

Respondents with average to good health status were selected to avoid the experimental errors.

The mean systolic blood pressure was found to be  $108.33 \pm 11.96$  mm/Hg, while diastolic blood pressure was 75.3 mm/Hg, mean pulse rate was  $81.2 \pm 8.45$  bpm and pulse pressure was  $30.7 \pm 6.71$  mm/Hg. All the respondents seemed to have normal blood pressure irrespective of the age group.

**Table 3: Health Status of the Respondents**

Parameters of Health Status	Recommended Value	Observed Value	Remarks
Systolic blood pressure (mm/Hg)	120	$106.0 \pm 10.08$	Normal
Diastolic blood pressure (mm/Hg)	70-80	$74.53 \pm 7.2$	Normal
Pulse rate (bpm)	86	$81.2 \pm 8.4$	Normal
Pulse pressure (mm/Hg)	30-50mm/Hg	$30.7 \pm 6.7$	Normal

**Table 4: Pinch Strength of the Respondents**

Pinch Strength	Left Hand		Right Hand	
	Mean	SD	Mean	SD
Before activity	19.33	4.46	22.86	2.77
After the activity	17.26	4.39	20.6	2.79
% of pinch fatigue	11.12	3.2	10.0	3.47

Pinch grip strength was measured to assess the biomechanical stress experienced due to the use of ring cutter for

pruning purpose. Readings were taken before and after the use of ring cutter. There was a reduction in the pinch strength for left hand compared to right hand irrespective of the age groups.

Average pinch grip strength for left hands before and after the use of ring cutter for pruning vines was found to be 19.33 and 17.26 respectively. The pinch grip fatigue was found to be 11.12 per cent. Whereas for right hand, pinch grip strength before and after the use of ring cutter was 22.86 and 20.53 respectively with a pinch grip fatigue of 10 per cent.

However, the average cuts per minute in traditional method was 5-7 and 11-13 in improved method. The percentage of increase in cuts per minute by using ring cutter was 57%.

**Table 5: Body Discomfort Experienced by the Respondents while Pruning the Vines**

Body Parts	No Discomfort (%)	Slightly Discomfort (%)	Moderate Discomfort (%)	Heavy Discomfort (%)	Mean	SD
Neck	-	-	20.0	30.0	2.60	0.5
Shoulder	-	-	23.3	26.7	2.53	0.5
Upper Back	0.9	6.7	16.7	16.7	1.80	1.1
Upper Arms	0.6	13.3	3.3	26.7	2.00	1.2
Mid back	0.0	26.7	23.3	-	1.47	0.5
Lower Arms	0.0	20.0	16.7	13.3	1.87	0.8
Lower back	0.9	6.7	16.7	16.7	1.80	1.1
Buttocks	1.2	20.0	16.7	-	1.07	0.8
Thighs	1.2	16.7	3.3	16.7	1.47	1.2
Legs	-	16.7	13.3	20.0	2.07	0.9

The mean score of body discomfort shows that there was a moderate discomfort experienced by respondents in various parts like neck, shoulder, upper arms and legs as the height of the plant is 5ft with vines grown above it requires a woman to raise legs little bit and do the pruning.

**Table 6: Angle Deviation of Body Parts of the Respondents**

Angle deviation	Traditional Method		Improved Method		t-Value
	Mean	SD	Mean	SD	
Shoulder	29.7	7.4	33.1	10.2	0.30 ns
Elbow	118.2	24.4	107.7	26.4	0.26 ns
Wrist	151.2	8.9	151.5	13.6	0.94 ns

The mean shoulder angle of deviation while pruning in a traditional method was 29.7 and 33.1 i.e. little bit above the neutral angle in improved method which implies that due to the new tool and lack of practice perhaps respondents need to extend the shoulder a little bit. However, there was a reduction in the elbow angle in improved method compared to the traditional method. The wrist angle of deviation was more or less same in both the methods irrespective of the age group because vines are above their shoulder height which invariably requires extension movements rather than flexion movements. They need to bend laterally by raising their hands, head and shoulders to prune the vines.



Figure 1: Pruning Done by Bare Hands



Figure 2: Pruning Done by using Ring Cutter

Table 7 Physiological Work Load of the Respondents

Physiological Variables	Traditional Method		Improved Method		t-Value
	Mean	S.D	Mean	S.D	
Resting Heart Rate	81.20	8.5	76.40	4.1	2.0854*
Working Heart Rate	123.55	14.6	113.75	13.1	1.93 ns
Recovery Heart Rate	87.67	10.1	86.88	7.4	0.24 ns
Cardiac Cost of work (CCW)	211.77	64.4	186.77	59.1	1.1077 ns
Cardiac Cost of Recovery (CCR)	32.33	21.7	52.41	30.6	2.0731*
Total Cardiac cost of work (TCCW/30 min. duration)	244.10	62.6	239.18	47.5	0.2425 ns
PCW	48.82	12.5	47.83	9.4	0.24 ns

Mean heart rate was 76.4 beats/mn. Per cent increase in heart rate was found to be 48 per cent while pruning the vines. The mean Working Heart Rate in pruning vines was 123 beats / min. while doing it by hands. When the pruning activity was performed with improved method, i.e. by using ring cutters, the working heart rate was reduced by 8 per cent. Total Cardiac Cost of Work was reduced in improved method by 2 per cent. Statistical test revealed no significant reduction for all the selected parameters except for resting heart rate and cardiac cost of recovery.

## CONCLUSIONS

Pruning activity is done by women farmers in grape vineyards. It is found to be very strenuous indulging in the repetitive and awkward standing postures in a day for 6-7 hours. The repetitive movements of pruning activity resulted in moderate muscular pain especially in the neck, upper arm, shoulder and legs, which suggests that an ergonomic intervention is essential to reduce their drudgery. In the present study, a ring cutter was given to them for pruning purpose which helped in increasing the output by 57%. However, farmers need to be trained enough in using the tool for work simplification and to achieve maximum benefits in reducing the exertion, perceived cost of work and muscular skeletal pain.

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